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EXAMINER	
HANSEN, STUART ALAN	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

TH

Office Action Summary	Application No.	Applicant(s)
	10/534,795	TSURUYA, MAMORU
	Examiner	Art Unit
	Stuart Hansen	2838

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 July 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is written in response to the Application 10/534,795 filed May 12, 2005. It is also acknowledged that this Application is under National Stage under PCT/JP04/08323 filed June 14, 2004, and is eligible for Foreign Priority under JP2003-291594 filed August 11, 2003.

Response to Arguments

2. Applicant's arguments with respect to claims 1 – 12 have been considered but are moot in view of the new ground(s) of rejection. Because the new grounds of rejection have been necessitated by amendments made the Applicant, this Office Action is made final.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 1-3 & 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over LaFleur et al. (US 6,600,402 B1, filed 10/20/1998, dated 7/29/2003), in view of Roberts (US 4,613,841, filed 4/15/1985, dated 9/23/1986), and further in view of Hess et al. (US 2002/0190831 A1, filed 12/6/2000, dated 12/19/2002).

With respect to claim 1, LaFleur et al. teaches: A switching power supply (Fig 3) comprising: a first series circuit, connected to both terminals of a direct current power supply (Fig 3 [V_{IN}]), in which a primary winding (Fig 3 [23]) of a transformer (Fig 3 [24]), and a first switch (Fig 3 [28]) are connected in series; a second series circuit (Fig 3 [30]), connected to one of both terminals of the first switch (Fig 3 [28]) and both terminals of the primary winding (Fig 3 [23]), in which a second switch and a capacitor are connected in series (Fig 3 [30]); and a smoothing circuit (Fig 3 [32, 33]) smoothing a voltage developed across a secondary winding (Fig 3 [26]) of the transformer (Fig 3 [24]).

LaFleur et al. lacks anticipation however by not teaching: a reactor in the first series circuit, the second series circuit being connected to the reactor in series with the primary winding, a control circuit alternately turning on and turning off the first and second switches, wherein the transformer, formed with magnetic circuit includes; a main core, made of magnetic material, on which the primary and secondary windings are wound with a given gap; and a plurality of auxiliary cores, made of magnetic material, which are disposed in the given gap with a given distance in a circumferential direction of the primary winding, and wherein the reactor is formed of a leakage inductance of the transformer, the leakage inductance having a value set by adjusting a number of auxiliary cores or a length of the auxiliary cores.

The transformer (Fig 3 [24]) with primary (Fig 3 [23]) and secondary (Fig 3 [26]) windings of LaFleur et al. is depicted as an ideal transformer. It is well known, however, that all transformers are not ideal and will inherently exhibit leakage inductance which

can be modeled as an extra reactance in series with the primary winding. Therefore there is inherently a reactance formed of a leakage inductance of the transformer, that it is in series with the first series circuit, and that it is also in series with the second series circuit. It would have been obvious to one of ordinary skill in the art at the time of the invention that a control circuit exists to alternately turn on and off the first and second switches, as is alluded to in the discussion of zero-voltage switching (column 1 lines 53-65). The control circuit is necessary because without it, the switching power converter (Fig 3) would not perform its function if the switches were constantly open or closed and not operated repeatedly in succession.

Roberts teaches: wherein the transformer, formed with a magnetic circuit includes; a main core (Fig 9 [120]), made of magnetic material, on which the primary (Fig 9 [10]) and secondary (Fig 9 [20]) windings are wound with a given gap (Fig 9 [105]); and an auxiliary core (Fig 9 [153]).

Both Roberts and LaFleur et al. use transformers for voltage conversion, therefore it would have been obvious to replace the transformer of the direct current voltage converter of LaFleur et al. for the transformer of Roberts for the purpose creating a more stable structure which lends itself to controlling a leakage inductance value with an air gap to better accommodate zero-voltage switching.

Roberts and LaFleur et al. fail to teach: a plurality of auxiliary cores, made of magnetic material, which are disposed in the given gap with a given distance in a circumferential direction of the primary winding, and wherein the reactor is formed of a

leakage inductance of the transformer, the leakage inductance having a value set by adjusting a number of auxiliary cores or a length of the auxiliary cores.

Hess et al. however does teach: a plurality of auxiliary cores (Fig 1 [KB]), made of magnetic material, with a given distance in a circumferential direction (Page 2 paragraphs 23 and 24).

Hess et al. uses a very common magnetic circuit therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the magnetic circuit of Figure 1 of Hess in place of the non-magnetic auxiliary core of the gap of Roberts et al. for the purpose of increasing the magnetic flux of the core, creating a more stable and controlled leakage inductance value which can be set by adjusting the number of auxiliary cores or adjusting the auxiliary cores lengths which changes the magnetic permeability of the gap region, and can create a more linear relationship between the power transferred from the primary winding to the secondary winding resulting in more stable operation.

Regarding claim 2, LaFleur et al. in view of Roberts, further in view of Hess et al. teaches: a cylindrical inner bobbin (Fig 9 [152]) on which the primary winding (Fig 9 [10]) is wound; and an outer bobbin (Fig 9 [150, 151]) having a diameter larger than that of the inner bobbin (Fig 9 [152]) on which the secondary winding (Fig 9 [20]) is wound, and having a plurality of slits (Fig 9 [105]), formed in a given distance along the circumferential direction, which accommodate the plurality of auxiliary cores (Fig 1 [KB] of Hess et al.), respectively, and wherein the inner bobbin (Fig 9 [152]) is mounted to

the main core (Fig 9 [120]) under a condition where the inner bobbin (Fig 9 [152]) is inserted to the outer bobbin (Fig 9 [150, 151]).

In regard to claim 3, LaFleur et al. teaches: A switching power supply (Fig 3) comprising: a first series circuit, connected to both terminals of a direct current power supply (Fig 3 [V_{IN}]), in which a primary winding (Fig 3 [23]) of a transformer (Fig 3 [24]), and a first switch (Fig 3 [28]) are connected in series; a second series circuit (Fig 3 [30]), connected to one of both terminals of the first switch (Fig 3 [28]) and both terminals of the primary winding (Fig 3 [23]), in which a second switch and a capacitor are connected in series (Fig 3 [30]); and a smoothing circuit (Fig 3 [32, 33]) smoothing a voltage developed across a secondary winding (Fig 3 [26]) of the transformer (Fig 3 [24]).

LaFleur et al. lacks anticipation however by not teaching: a reactor in the first series circuit, the second series circuit being connected to the reactor in series with the primary winding, a control circuit alternately turning on and turning off the first and second switches, wherein the transformer, formed with magnetic circuit includes; a main core, made of magnetic material, that has: a cylindrical inner bobbin on which the primary winding is wound; and an outer bobbin having a diameter larger than that of the inner bobbin, on which the secondary winding is wound, the outer bobbin being made of an insulating magnetic material, and wherein the inner bobbin is mounted to the main core under a condition where the inner bobbin is inserted to the outer bobbin, and wherein the reactor is formed of a leakage inductance of the transformer, the leakage

inductance having a value set by adjusting a magnetic permeability of the insulating magnetic material.

The transformer (Fig 3 [24]) with primary (Fig 3 [23]) and secondary (Fig 3 [26]) windings of LaFleur et al. is depicted as an ideal transformer. It is well known, however, that all transformers are not ideal and will inherently exhibit leakage inductance, that is determined by the magnetic permeability of the insulating material, which can be modeled as an extra reactance in series with the primary winding. Therefore there is inherently a reactance formed of a leakage inductance of the transformer, that it is in series with the first series circuit, and that it is also in series with the second series circuit. It would have been obvious to one of ordinary skill in the art at the time of the invention that a control circuit exists to alternately turn on and off the first and second switches, as is alluded to in the discussion of zero-voltage switching (column 1 lines 53-65). The control circuit is necessary because without it, the switching power converter (Fig 3) would not perform its function if the switches were constantly open or closed and not operated repeatedly in succession.

Roberts however, does teach: a cylindrical inner bobbin (Fig 9 [152]) on which the primary winding (Fig 9 [10]) is wound; and an outer bobbin (Fig 9 [150, 151]) having a diameter larger than that of the inner bobbin on which the secondary winding (Fig 9 [20]) is wound, and wherein the inner bobbin (Fig 9 [152]) is mounted to the main core (Fig 9 [120]) under a condition where the inner bobbin (Fig 9 [152]) is inserted to the outer bobbin (Fig 9 [150, 151]).

Both Roberts and LaFleur et al. use transformers for voltage conversion, therefore it would have been obvious to replace the transformer of the direct current voltage converter of LaFleur et al. for the transformer of Roberts for the purpose creating a more stable structure which lends itself simple assembly which is a well known benefit to using bobbins for transformer construction.

Roberts and LaFleur et al. both fail to teach: the outer bobbin being made of an insulating magnetic material, and the leakage inductance having a value set by adjusting a magnetic permeability of the insulating magnetic material.

Hess et al. however teaches the use of a ferrite polymer composite (FPC) material which exhibits strong magnetic permeability which is now commonly used as transformer and toroid cores as well as other magnetic circuits because it exhibits little electrical losses due to Eddy currents while maintaining the high magnetic permeability.

Hess et al. teaches the use of a material which was very common at the time the invention was made, therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made that the outer bobbin would be made of an insulating magnetic material, such as FPC, because of its high magnetic permeability which increases transformer power transfer efficiency, and it would have further been obvious to one of ordinary skill in the art at the time the invention was made that the leakage inductance value is directly affected by magnetic permeability of transformer insulating materials.

Regarding claim 7, LaFleur et al. in view of Roberts, further in view of Hess et al. lacks anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Regarding claim 8, LaFleur et al. in view of Roberts, further in view of Hess et al. lacks anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the

primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Regarding claim 9, LaFleur et al. in view of Roberts, further in view of Hess et al. lacks anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully

discharged, and that would be an opportune point to switch, allow zero-voltage switching.

4. Claims 4 – 6 & 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over LaFleur et al. (US 6,600,402 B1, filed 10/20/1998, dated 7/29/2003) in view of Harris et al. (US Re. 31,840, filed 7/7/1982, dated 2/26/1985), in view of Roberts (US 4,613,841, filed 4/15/1985, dated 9/23/1986), and further in view of Hess et al. (US 2002/0190831 A1, filed 12/6/2000, dated 12/19/2002).

With respect to claim 4, LaFleur et al. teaches: A switching power supply (Fig 3) comprising: a first series circuit, connected to both terminals of a direct current power supply (Fig 3 [V_{IN}]), in which a primary winding (Fig 3 [23]) of a transformer (Fig 3 [24]), and a first switch (Fig 3 [28]) are connected in series; a second series circuit (Fig 3 [30]), connected to one of both terminals of the first switch (Fig 3 [28]) and both terminals of the primary winding (Fig 3 [23]), in which a second switch and a capacitor are connected in series (Fig 3 [30]); and a smoothing circuit smoothing a voltage developed across a secondary winding (Fig 3 [26]) of the transformer (Fig 3 [24]).

LaFleur et al. lacks anticipation however by not teaching: a reactor in the first series circuit, the second series circuit being connected to the reactor in series with the primary winding, a control circuit alternately turning on and turning off the first and second switches, a feedback winding, located on a secondary side of the transformer, which allows energy stored in the reactor when the first switch is turned on to be circulated to the secondary side when the first switch is turned off, wherein the transformer, formed with a magnetic circuit, including: a main core, made of magnetic

material and formed with a mirror E-shape, that has a central leg on which the primary winding of the transformer and the feedback winding are wound with a first given gap; a first side core formed with a second given gap, and a second side core on which the secondary winding of the transformer is wound; and a plurality of auxiliary cores, made of magnetic material, which are disposed in the first given gap with a given distance in a circumferential direction of the primary winding, and wherein the reactor is formed of a leakage inductance of the transformer, the leakage inductance having a value set by adjusting a number of the auxiliary cores or a length of the auxiliary cores.

The transformer (Fig 3 [24]) with primary (Fig 3 [23]) and secondary (Fig 3 [26]) windings of LaFleur et al. is depicted as an ideal transformer. It is well known, however, that all transformers are not ideal and will inherently exhibit leakage inductance which can be modeled as an extra reactance in series with the primary winding. Therefore there is inherently a reactance formed of a leakage inductance of the transformer, that it is in series with the first series circuit, and that it is also in series with the second series circuit. It would have been obvious to one of ordinary skill in the art at the time of the invention that a control circuit exists to alternately turn on and off the first and second switches, as is alluded to in the discussion of zero-voltage switching (column 1 lines 53-65). The control circuit is necessary because without it, the switching power converter (Fig 3) would not perform its function if the switches were constantly open or closed and not operated repeatedly in succession.

Harris et al. however does teach: a feedback winding (Fig 2 [70T]) located on a secondary side of the transformer (Fig 2), which allows energy stored in the reactor

when the first switch (Fig 1 [13]) is turned on to be circulated to the secondary side when the first switch (Fig 1[13]) is turned off, wherein the transformer, formed with a magnetic circuit, including: a main core (Fig 2 [15]) that has a central leg (Fig 2 [left pole]) on which the primary winding (Fig 2 [16]) of the transformer (Fig 2 [14]) and the feedback winding (Fig 2 [70T]) are wound with a first given gap (Fig 2 [gap between primary and feedback windings]), and a side core (Fig 2 [Stackpole 24B]) on which the secondary winding (Fig 2 [145T]) of the transformer (Fig 2 [14]) is wound.

Harris et al. and LaFleur et al. both teach voltage conversion systems, therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the transformer of Harris et al. with the conversion circuit of LaFleur et al. for the purpose of introducing a feedback winding coupled to the primary side, connected to the secondary side to allow excess magnetization energy to flow to the secondary side, increasing efficiency and conserving energy.

Harris et al. however fails to teach: the main transformer core, made of magnetic material and formed with a mirror E-shape, a first side core formed with a second given gap; and a plurality of auxiliary cores, made of magnetic material, which are disposed in the first given gap with a given distance in a circumferential direction of the primary winding.

Roberts however does teach: the primary winding (Fig 9 [10]) of the transformer (Fig 9) and the feedback winding (Fig 9 [20]) are wound with a given gap (Fig 9 [105]); and wherein the transformer, formed with a magnetic circuit, including a main core, made of magnetic material and formed with a mirror E-shape (Fig 2).

Roberts and the combined device of Harris et al. and LaFleur et al. both teach voltage conversion circuitry and transformers, so it therefore would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the transformer of Roberts with the main core of the transformer of the combined device of LaFleur et al. and Harris et al., substituting the secondary winding with a feedback winding. This combination would have allowed a controllable, more ideal means for regulating excess magnetic flux in the transformer during operation helping to avoid saturation with can lead to faulty converter operation.

Roberts though fails to teach: a plurality of auxiliary cores, made of magnetic material, which are disposed in the given gap with a given distance in a circumferential direction of the primary winding; and the leakage inductance having a value set by adjusting a number of auxiliary cores or a length of the auxiliary cores.

Hess et al. however does teach: a plurality of auxiliary cores (Fig 1 [KB]), made of magnetic material, with a given distance in a circumferential direction (Page 2 paragraphs 23 and 24).

Hess et al. uses a very common magnetic circuit therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the magnetic circuit of Figure 1 of Hess in place of the non-magnetic auxiliary core of the gap of Roberts et al. for the purpose of increasing the magnetic flux of the core, creating a more stable and controlled leakage inductance value which can be set by adjusting the number of auxiliary cores or adjusting the auxiliary cores lengths which changes the magnetic permeability of the gap region, and can create a more linear relationship

between the power transferred from the primary winding to the secondary winding resulting in more stable operation.

Regarding claim 5, the combined device with the main core of Harris et al. with the transformer of Roberts further teaches: a cylindrical inner bobbin (Fig 9 [152]) on which the primary winding (Fig 9 [10]) is wound; and an outer bobbin (Fig 9 [150, 151]) having a diameter larger than that of the inner bobbin on which the feedback winding (Fig 9 [20]) is wound, and having a plurality of slits (Fig 9 [105]), formed in a given distance along the circumferential direction, which accommodate the plurality of auxiliary cores (Fig 9 [153]), respectively, and wherein the inner bobbin (Fig 9 [152]) is mounted to the central leg of the main core (Fig 9 [120]) under a condition where the inner bobbin (Fig 9 [152]) is inserted to the outer bobbin (Fig 9 [150, 151]).

With respect to claim 6, LaFleur et al. teaches: A switching power supply (Fig 3) comprising: a first series circuit, connected to both terminals of a direct current power supply (Fig 3 [V_{IN}]), in which a primary winding (Fig 3 [23]) of a transformer (Fig 3 [24]), and a first switch (Fig 3 [28]) are connected in series; a second series circuit (Fig 3 [30]), connected to one of both terminals of the first switch (Fig 3 [28]) and both terminals of the primary winding (Fig 3 [23]), in which a second switch and a capacitor are connected in series (Fig 3 [30]); and a smoothing circuit (Fig 3 [32, 33]) smoothing a voltage developed across a secondary winding (Fig 3 [26]) of the transformer (Fig 3 [24]).

LaFleur et al. lacks anticipation however by not teaching: a reactor in the first series circuit, the second series circuit being connected to the reactor in series with the

primary winding, a control circuit alternately turning on and turning off the first and second switches; and a feedback winding, located on a secondary side of the transformer, which allows energy stored in the reactor when the first switch is turned on to be circulated to the secondary side when the first switch is turned off, wherein the transformer, formed with magnetic circuit includes a main core, made of magnetic material and formed with a mirror E-shape, that has: a central leg mounted with a cylindrical inner bobbin on which the primary winding is wound; and an outer bobbin, having a diameter larger than that of the inner bobbin, on which the feedback winding is wound, the outer bobbin being made of an insulating magnetic material and wherein the inner bobbin is mounted to the central leg of the main core under a condition wherein the inner bobbin is inserted to the outer bobbin, a first side core formed with a given gap, and a second side core on which the secondary winding of the transformer is wound; and wherein the reactor is formed of a leakage inductance of the transformer, the leakage inductance having a value set by adjusting a magnetic permeability of the insulating magnetic material.

The transformer (Fig 3 [24]) with primary (Fig 3 [23]) and secondary (Fig 3 [26]) windings of LaFleur et al. is depicted as an ideal transformer. It is well known, however, that all transformers are not ideal and will inherently exhibit leakage inductance, that is determined by the magnetic permeability of the insulating material, which can be modeled as an extra reactance in series with the primary winding. Therefore there is inherently a reactance formed of a leakage inductance of the transformer, that it is in series with the first series circuit, and that it is also in series with the second series

circuit. It would have been obvious to one of ordinary skill in the art at the time of the invention that a control circuit exists to alternately turn on and off the first and second switches, as is alluded to in the discussion of zero-voltage switching (column 1 lines 53-65). The control circuit is necessary because without it, the switching power converter (Fig 3) would not perform its function if the switches were constantly open or closed and not operated repeatedly in succession.

Harris et al. however does teach: a feedback winding (Fig 2 [70T]) located on a secondary side of the transformer (Fig 2), which allows energy stored in the reactor when the first switch (Fig 1 [13]) is turned on to be circulated to the secondary side when the first switch (Fig 1[13]) is turned off, wherein the transformer, formed with a magnetic circuit, including: a main core (Fig 2 [15]) that has a central leg (Fig 2 [left pole]) on which the primary winding (Fig 2 [16]) of the transformer (Fig 2 [14]) and the feedback winding (Fig 2 [70T]) are wound with a first given gap (Fig 2 [gap between primary and feedback windings]), and a side core (Fig 2 [Stackpole 24B]) on which the secondary winding (Fig 2 [145T]) of the transformer (Fig 2 [14]) is wound.

Harris et al. and LaFleur et al. both teach voltage conversion systems, therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the transformer of Harris et al. with the conversion circuit of LaFleur et al. for the purpose of introducing a feedback winding coupled to the primary side, connected to the secondary side to allow excess magnetization energy to flow to the secondary side, increasing efficiency and conserving energy.

Harris et al. however fails to teach: the main transformer core, made of magnetic material and formed with a mirror E-shape, a first side core formed with a second given gap; and a plurality of auxiliary cores, made of magnetic material, which are disposed in the first given gap with a given distance in a circumferential direction of the primary winding.

Roberts however does teach: the primary winding (Fig 9 [10]) of the transformer (Fig 9) and the feedback winding (Fig 9 [20]) are wound with a given gap (Fig 9 [105]); and wherein the transformer, formed with a magnetic circuit, including a main core, made of magnetic material and formed with a mirror E-shape (Fig 2); and a cylindrical inner bobbin (Fig 9 [152]) on which the primary winding (Fig 9 [10]) is wound; and an outer bobbin (Fig 9 [150, 151]) having a diameter larger than that of the inner bobbin on which the secondary winding (Fig 9 [20]) is wound,.and wherein the inner bobbin (Fig 9 [152]) is mounted to the main core (Fig 9 [120]) under a condition where the inner bobbin (Fig 9 [152]) is inserted to the outer bobbin (Fig 9 [150, 151]).

Roberts and the combined device of Harris et al. and LaFleur et al. both teach voltage conversion circuitry and transformers, so it therefore would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the transformer of Roberts with the main core of the transformer of the combined device of LaFleur et al. and Harris et al., substituting the secondary winding with a feedback winding. This combination would have allowed a controllable, more ideal means for regulating excess magnetic flux in the transformer during operation helping to avoid saturation with can lead to faulty converter operation.

Roberts though fails to teach: a plurality of auxiliary cores, made of magnetic material, which are disposed in the given gap with a given distance in a circumferential direction of the primary winding; and the leakage inductance having a value set by adjusting a number of auxiliary cores or a length of the auxiliary cores; and the outer bobbin being made of an insulating magnetic material, and the leakage inductance having a value set by adjusting a magnetic permeability of the insulating magnetic material.

Hess et al. however does teach: a plurality of auxiliary cores (Fig 1 [KB]), made of magnetic material, with a given distance in a circumferential direction (Page 2 paragraphs 23 and 24); and the use of a material which was very common at the time the invention was made, therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made that the outer bobbin would be made of an insulating magnetic material, such as FPC, because of its high magnetic permeability which increases transformer power transfer efficiency, and it would have further been obvious to one of ordinary skill in the art at the time the invention was made that the leakage inductance value is directly affected by magnetic permeability of transformer insulating materials..

Hess et al. uses a very common magnetic circuit therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the magnetic circuit of Figure 1 of Hess in place of the non-magnetic auxiliary core of the gap of Roberts et al. for the purpose of increasing the magnetic flux of the core, creating a more stable and controlled leakage inductance value which can be set by

adjusting the number of auxiliary cores or adjusting the auxiliary cores lengths which changes the magnetic permeability of the gap region, and can create a more linear relationship between the power transferred from the primary winding to the secondary winding resulting in more stable operation.

Regarding claim 10, LaFleur et al. in view of Roberts, further in view of Hess et al. lacks anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Regarding claim 11, LaFleur et al. in view of Roberts, further in view of Hess et al. lacks anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Regarding claim 12, LaFleur et al. in view of Roberts, further in view of Hess et al. lacks anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the

second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stuart Hansen whose telephone number is 571-270-

1611. The examiner can normally be reached on 7:30- 5 M-Th, Alt. Frid 7:30-4 Est Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Karl Easthom can be reached on 571-272-1989. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Stuart Hansen
September 6, 2007

KARL EASTHOM
SUPERVISORY PATENT EXAMINER